PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION.

Improvements in or relating to Ball Bearings.

We, HARRY SIBBERING WOOD, of Rudge-Whitworth, Limited, Reddings Lane, Sparkhill, Birmingham, in the County of Warwick, a British subject, and RUDGE-WHITWORTH, LIMITED, of Rudge Works, Crow Lane, Coventry, in the County of Warwick, a company registered under the laws of Great Britain, do hereby declare the nature of this invention to be as follows:—

This invention relates to ball bearings of the type in which a cage is used for separating or spacing the balls, and filling slots are provided in both inner and outer race rings, and it relates particularly to the form of cage and the method of assembling the component parts of the bearing.

The object of the invention is to provide a cage which is simple to manufacture and with which the bearing can be assembled with facility.

Cages of this type of bearing are commonly formed of two similar parts or rings having substantially equally spaced holes formed half in one ring and half in the other for the reception of the balls, and these two rings are rivetted together by rivets which pass through the metal forming the dividing walls between the balls.

The invention consists in a cage formed in one piece in which three substantially equidistant holes for the reception of balls are drilled radially through the thickness of the ring, and the remaining balls are accommodated in holes or slots so formed that each ball may be entered in a direction parallel to the axis of the bearing instead of radially, as in the three balls first mentioned.

The invention further consists in improvements in or relating to ball bearings as hereinafter described.

The inner race and outer race of the bearing may be of usual form in which races or tracks for the balls are formed on the inside of the outer ring and on the outside of the inner ring, and the filling slot is provided in each ring cut transversely to the race or track to allow each ball to be pressed into place when the inner and outer races are in relative position and by the slight deformation of either or both races in the manner well known in ball bearing manufacture.

The cage is formed in a single piece as a ring, the inner and outer diameters of which may be substantially the same as the usual form of cage or separator. Three holes are formed substantially equally spaced round the circumference of the ring, so that balls may be entered into these holes in a radial direction, and that when entered will stand proud of or protrude from the inner and outer surfaces of the ring. Holes for other balls are provided round the circumference of the ring of such a form that each ball may be entered into its hole by an axial movement through the side or face of the ring as opposed to the radial entry of the first three balls, it being understood that all these balls other than the three radially entering ones must be entered from one side of the cage. These latter holes or slots are so arranged that when all the balls are in position their centres may all lie in a plane at right angles to the axis of the bearing.

To erect the bearing, the cage alone is slipped over the inner race into its normal position, three balls are then inserted in the three radial holes, and the cage inner ring and three balls are offered into the outer ring so that the axis of the inner ring and cage is inclined to the axis of the outer ring and so that two of the three balls lie in the track or race of the outer ring and the third ball registers

[*Price* 1/-]

with the filling slot of both inner and outer rings which must of course be rotated relatively until they are opposite one another, and so that the remaining open ended holes for the balls and the filling slots are uppermost or facing the same direction. Pressure is then applied to the cage at the point where the third ball lies within the filling slots and the inner ring cage and third ball will then drop into place within the outer ring; the two first balls acting as a pivot round which the cage and inner turn. The cage and inner are now rotated relatively to the outer to enable the remaining balls each to be inserted in their proper slot in the cage through the filling slots in the inner and outer ring.

The filling slots, as is usual in this type of bearing, are so proportioned that the bottom of this slot where it cuts into the race or track is not quite so deep as the bottom of the track itself so that the third ball and all the remaining balls require slight deformation of the inner and/or outer races to take place as they are pressed into position in between the two tracks.

It will be seen that this type of cage eliminates all rivetting and reduces the amount of machining. Further a larger number of balls can be inserted in any bearing, as the space used by the rivets is saved, with the result that the balls may be placed closer together.

It will be clear that the cage is retained in position axially when the bearing is assembled by the three balls which are housed in the radial holes, and the remaining balls are spaced circumferentially by the cage.

The invention is not restricted to the three balls being equidistantly spaced round the cage, and although this is the preferable construction, the two balls which are first offered into the outer race track may be closer together or farther apart than they are respectively from the third ball which is caused to register with the two filling slots.

It is to be understood that any form of hole in the cage which allows radial entry may be used for the first three balls, and any form of hole in the cage which allows entry from one side of the cage in an axial direction may be used for the remaining balls. A preferable form of hole for the axially entering balls may be produced by first drilling or forming a radial hole of approximately the diameter of the ball, and then drilling or forming a hole through the side wall of the cage in an axial direction, this latter hole being of a diameter slightly less than the diameter of the ball at the point where it enters or breaks into the radially drilled hole; the axial hole will of course break through the outer and inner cylindrical surface of the cage. This latter construction of hole is necessary where it is desired to use filling slots in the inner and outer race which are as deep as the race grooves or tracks for the balls, in order to prevent the balls falling out when both filling slots and a ball coincide.

We do not limit ourselves to the use of three balls in radial holes, as it will be clear that this construction can be utilised with two balls or with more than three, but in the latter case an additional filling slot will be required for every ball more than three. These constructions are not preferred, as the additional filling slot or slots are of course undesirable, and the location of the cage in the case of two balls only being employed is not so well carried out as in the case of three balls being used.

Dated this 11th day of December, 1923.

ETHEL BLAIR,
Acting for the Applicants.

COMPLETE SPECIFICATION.

Improvements in or relating to Ball Bearings.

We, HARRY SIBBERING WOOD, of Rudge-Whitworth, Limited, of Reddings Lane, Sparkhill, Birmingham, in the County of Warwick, a British subject, and RUDGE-WHITWORTH, LIMITED, of Rudge Works, Crow Lane, Coventry, in the County of Warwick, a company registered under the laws of Great Britain, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to ball bearings of the type in which a cage which may be formed as one piece is used for separating or spacing the balls, and filling slots are provided in both inner and outer race rings, and it relates particularly to that kind of such cages which have recesses for

the insertion of the balls at the side of a cage and/or ring and also into the cage in a radial direction before the cage and rings are assembled.

The function of the last mentioned balls is primarily to locate and prevent subsequent sidewise displacement of the cage and for this purpose the balls must be capable of entering the race in common with the cage which is not possible if there are too many of them. At the same time the number and disposition must be such as to ensure satisfactory constraint of the cage.

In connection with such cages it has been proposed (see British Patent No. 17,603 of 1909) to form the cage with eight recesses into which the balls may be inserted alternately from opposite sides of the cage, and a single radial opening containing a ball which of itself cannot perform the above constraining function. In a modification the cage has been provided with five radial openings round one half of the circumference and another radial opening in the middle of the other half with only the remaining four recesses adapted for the insertion of balls from the side of the bearing after the races have been tilted into one another with balls in the radial openings. The intervening balls of the five are then superfluous while to assemble such a bearing by tilting would either entail a considerable amount of slack in the races or the provision of a considerable number of filling grooves because with races accurately fitting the balls it would not be possible to insert the five balls far enough into the groove of the one race for the remaining radially positioned ball to pass through a filling slot of a normal type. It is further stated in the said specification that two or more radial openings may be employed in conjunction with other openings or ball recesses but without suggesting any particular number or disposition as giving the most satisfactory results.

The object of the present invention is to provide a cage with the smallest number of radially inserted balls that may be so disposed as to ensure easy assembling by tilting together and also providing efficient location and constraint of the cage.

The invention consists in a ball cage for the reception of balls inserted from the side and also in a radial direction in which only three radially directed openings are employed and positioned at points which are at not greatly different distances apart round the circumference of the cage so that the tilting of one of the two races with the cage having the three balls in position therein into the other race can be effected by the provision of only one filling groove.

The invention further consists in improvements in or relating to ball bearings as hereinafter described.

Referring now to the accompanying drawings:—

Figure 1 is a side elevation of a bearing in accordance with the invention.

Figure 2 is a section on the line A—A of Figure 1.

Figure 3 shows the cage ring separate from the bearing.

Figure 4 is a section on the line B—B of Figure 3, and

Figure 5 is a view, partly in section, showing the method of assembling the parts.

The inner race a and outer race b of the bearing may be of usual form in which races or tracks b^1, a^1 for the balls are formed on the inside of the outer ring b and on the outside of the inner ring a and a filling slot, such as b^2, is provided in each ring cut transversely to the race or track to allow each ball to be pressed into place when the inner and outer races a and b are in relative position and by the slight deformation of either or both races in the manner well known in ball bearing manufacture.

The cage c, Figures 3 and 4, is formed in a single piece as a ring, the inner and outer diameters of which may be substantially the same as the usual form of cage or separator. Three holes d, e and f are formed substantially equally spaced round the circumference of the ring, so that balls d^1, e^1 and f^1 may be entered into these holes in a radial direction, and that when entered will stand proud of or protrude from the inner and outer surfaces of the ring. Holes g for other balls g^1 are provided round the circumference of the ring of such a form that each ball g^1 may be entered into its hole g by an axial movement through the side or face of the ring as opposed to the radial entry of the first three balls d^1, e^1, f^1, it being understood that all these balls g^1 must be entered from one side of the cage. These latter holes or slots g are so arranged that when all the balls d^1, e^1, f^1 and g^1 are in position their centres may all lie in a plane at right angles to the axis of the bearing.

To erect the bearing, the cage c alone is slipped over the inner race a into its normal position, three balls d^1, e^1 and f^1 are then inserted in the three radial holes d, e and f and the cage inner ring and three balls are, with the filling slots of the inner and outer rings similarly directed, offered into the outer ring b, as

shown in Figure 5; so that the axis of the inner ring a and cage c is inclined to the axis of the outer ring b and so that the two balls e^1, f^1 lie in the track or race b^1 of the outer ring b and the third ball d^1 registers with the filling slot b^2 of the outer ring b which must, of course, be rotated until the slot is opposite the ball d^1 and so that the remaining open-ended holes for the balls g^1 are uppermost or facing in the same direction as the filling slots. Pressure is then applied to the inner ring a at the point where the third ball d^1 lies within the filling slot b^2 of the outer ring b and the inner ring a, cage c and third ball d^1 will then drop or snap into place within the outer ring b, the two first balls e^1, f^1 acting as a pivot round which the cage c and inner ring a turn. The cage c is now rotated relatively to the inner and outer rings a and b to enable the remaining balls g^1 each to be inserted in their proper slot g in the cage through the filling slots in the inner and outer rings a and b.

The filling slots, as for example b^2, as is usual in this type of bearing, are so proportioned that the bottom of the slot where it cuts into the race or track at b^3 is not quite so deep as the bottom of the track itself so that the third ball d^1 and all the remaining balls g^1 require slight deformation of the inner and/or outer races a and b to take place as they are pressed into position in between the two tracks.

It will be seen that this type of cage eliminates all riveting and reduces the amount of machining. Further, a larger number of balls can be inserted in any bearing, as the space used by the rivets is saved, with the result that the balls may be placed closer together.

It will be clear that the cage is retained in position axially when the bearing is assembled by the three balls d^1, e^1, f^1, which are housed in the radial holes d, e and f and the remaining balls are spaced circumferentially by the cage.

The invention is not restricted to the three balls being exactly equidistantly spaced round the cage, and although this is the preferable construction the two balls e^1, f^1 which are first offered into the outer race track may be somewhat closer together or farther apart than they are respectively from the third ball which is caused to register with the filling slot.

It is to be understood that any form of hole in the cage which allows radial entry may be used for the first three balls, d^1, e^1, f^1, and any form of hole in the cage which allows entry from one side of the cage in an axial direction may be used for the remaining balls g^1. A preferable form of hole g for the axially entering balls g^1 may be produced, as indicated in Figures 3 and 4, by first drilling or forming a radial hole of approximately the diameter of the ball, and then drilling or forming a hole through the side wall of the cage in an axial direction, this latter hole being of a diameter slightly less than the diameter of the ball at the region where it enters or breaks into the radially drilled hole; the axial hole will, as shown, break through the outer and inner cylindrical surface of the cage. This latter construction of hole is necessary where it is desired to use filling slots in the inner and outer race which are as deep as the race grooves or tracks for the balls in order to prevent the balls falling out when both filling slots and a ball coincide.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A ball cage for the reception of balls inserted from the side and also in a radial direction in which only three radially directed openings are employed and positioned at points which are at not greatly different distances apart round the circumference of the cage so that the tilting of one of the two races with the cage having the three balls in position therein into the other race can be effected by the provision of only one filling groove.

2. A ball cage according to Claim 1, having the three radially disposed cavities substantially equidistant from one another.

3. The improved ball bearing, substantially as described with reference to the accompanying drawings.

Dated this 5th day of September, 1924.

MARKS & CLERK.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1925.

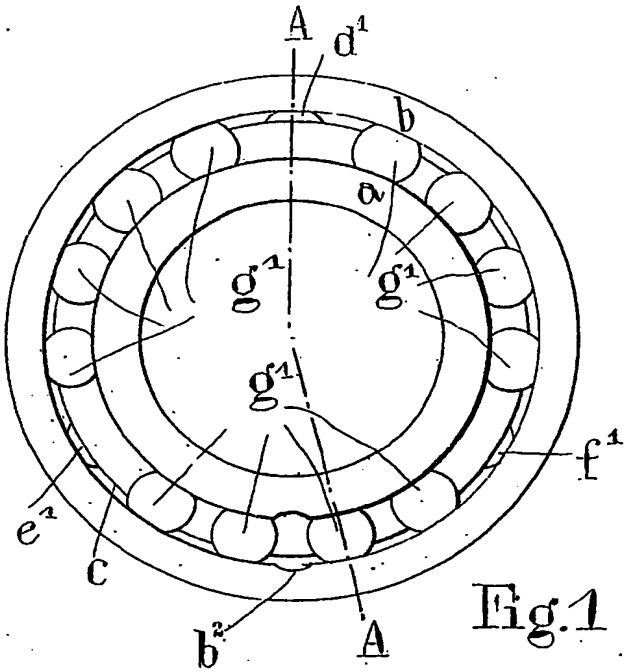

Fig.1

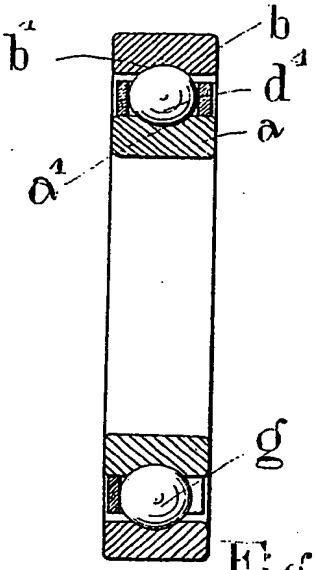

Fig.2

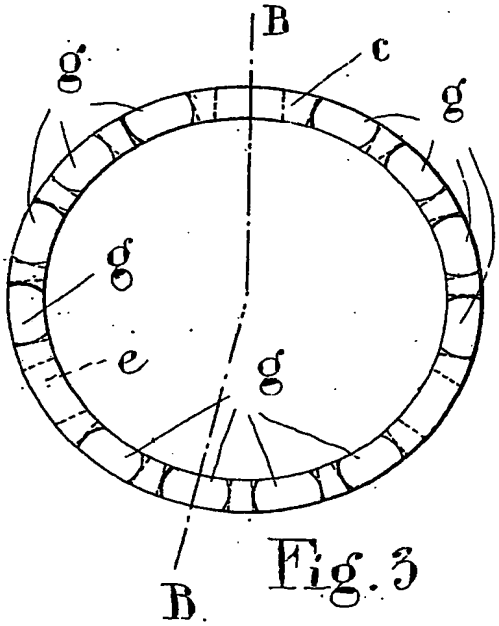

Fig.3

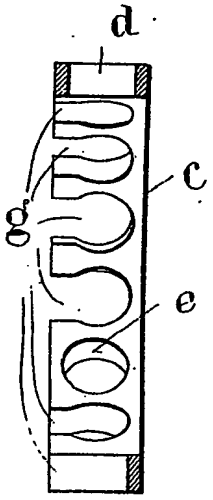

Fig.4

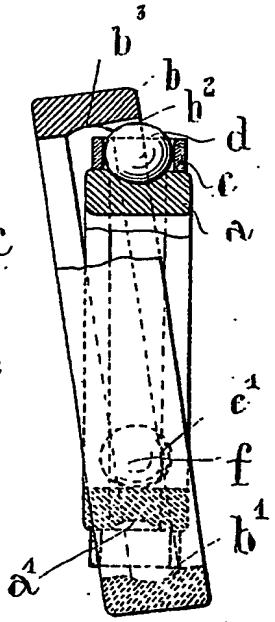

Fig.5.

Malby&Sons, Photo-Litho